

# BEST AVAILABLE COPY



**PCT**

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>6</sup> : <b>C08L 23/08, 43/04</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 98/12253</b></p> <p>(43) International Publication Date: 26 March 1998 (26.03.98)</p>		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <p>(21) International Application Number: <b>PCT/SE97/01561</b></p> <p>(22) International Filing Date: 16 September 1997 (16.09.97)</p> <p>(30) Priority Data: 9603371-7                      17 September 1996 (17.09.96)      SE</p> <p>(71) Applicant (for all designated States except US): <b>BOREALIS A/S [DK/DK]; Lyngby Hovedgade 96, DK-2800 Lyngby (DK).</b></p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): <b>SULTAN, Bernt-Åke [SE/SE]; Krukmakarevägen 8, S-444 96 Ödsmål (SE). HIRVENSAALO, Matti [FI/FI]; Ristiaallokonkatu 4E 123, FIN-02320 Espoo (FI). LAURELL, Jussi [FI/FI]; Länsitie 8 C 15, FIN-06400 Porvoo (FI).</b></p> <p>(74) Agent: <b>AWAPATENT AB; P.O. Box 11394, S-404 28 Göteborg (SE).</b></p> </td> <td style="width: 50%; border: none; vertical-align: top;"> <p>(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p style="text-align: center;"><b>Published</b> With international search report.</p> </td> </tr> </table>			<p>(21) International Application Number: <b>PCT/SE97/01561</b></p> <p>(22) International Filing Date: 16 September 1997 (16.09.97)</p> <p>(30) Priority Data: 9603371-7                      17 September 1996 (17.09.96)      SE</p> <p>(71) Applicant (for all designated States except US): <b>BOREALIS A/S [DK/DK]; Lyngby Hovedgade 96, DK-2800 Lyngby (DK).</b></p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): <b>SULTAN, Bernt-Åke [SE/SE]; Krukmakarevägen 8, S-444 96 Ödsmål (SE). HIRVENSAALO, Matti [FI/FI]; Ristiaallokonkatu 4E 123, FIN-02320 Espoo (FI). LAURELL, Jussi [FI/FI]; Länsitie 8 C 15, FIN-06400 Porvoo (FI).</b></p> <p>(74) Agent: <b>AWAPATENT AB; P.O. Box 11394, S-404 28 Göteborg (SE).</b></p>	<p>(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p style="text-align: center;"><b>Published</b> With international search report.</p>
<p>(21) International Application Number: <b>PCT/SE97/01561</b></p> <p>(22) International Filing Date: 16 September 1997 (16.09.97)</p> <p>(30) Priority Data: 9603371-7                      17 September 1996 (17.09.96)      SE</p> <p>(71) Applicant (for all designated States except US): <b>BOREALIS A/S [DK/DK]; Lyngby Hovedgade 96, DK-2800 Lyngby (DK).</b></p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): <b>SULTAN, Bernt-Åke [SE/SE]; Krukmakarevägen 8, S-444 96 Ödsmål (SE). HIRVENSAALO, Matti [FI/FI]; Ristiaallokonkatu 4E 123, FIN-02320 Espoo (FI). LAURELL, Jussi [FI/FI]; Länsitie 8 C 15, FIN-06400 Porvoo (FI).</b></p> <p>(74) Agent: <b>AWAPATENT AB; P.O. Box 11394, S-404 28 Göteborg (SE).</b></p>	<p>(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p style="text-align: center;"><b>Published</b> With international search report.</p>			
<p>(54) Title: <b>FLAME RETARDANT COMPOSITION</b></p> <p>(57) Abstract</p> <p>The present invention relates to a flame retardant composition comprising (A) a polymer which includes a copolymer of ethylene and at least one other comonomer including a vinyl unsaturated polybishydrocarbylsiloxane; and (B) an inorganic filler comprising at least one member selected from the group consisting of oxides, hydroxides and carbonates of aluminium, magnesium, calcium and barium. It also relates to a cable or wire comprising such a composition.</p>				

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

FLAME RETARDANT COMPOSITION

The present invention relates to a flame retardant composition and to a cable or wire having a layer comprising such a flame retardant composition.

It is known to use flame retardant compositions containing halides.

It is also known to increase the flame retardancy of polymer compositions by incorporating into the compositions relatively large amounts, typically 50 to 60% by weight, of inorganic fillers which decompose endothermically liberating an inert gas at a temperature in the range of 200 to 600°C. In the 1970s use of aluminium hydroxide  $\text{Al}(\text{OH})_3$  was prevalent. In the 1990s use of  $\text{Mg}(\text{OH})_2$  became more frequent. Also  $\text{CaCO}_3$  has been used for the same purposes.

Flame retardant additive systems which use silicone fluids have also been proposed for use in polyolefin compositions. For example EP 0 393 959 discloses a flame retardant polymer composition comprising (A) an organic polymer, at least 40% by weight of which is a copolymer of ethylene with one or more comonomers selected from the group consisting of  $\text{C}_1$  to  $\text{C}_8$  alkyl acrylates,  $\text{C}_1$  to  $\text{C}_8$  alkyl methacrylates, acrylic acid, methacrylic acid and vinyl acetate, (B) a silicone fluid or gum, and (C) an inorganic filler which is a compound of a metal of Group II A of the Periodic Table of Elements (on the inside cover of Perry et al "Chemical Engineers' Handbook" 5th edition 1973), but which is neither a hydroxide nor a substantially hydrated compound.

A disadvantage with the flame retardant compositions containing halides is that on combustion they release halide containing compounds which are harmful to the environment.

A disadvantage with the known silicone containing compositions is that silicone gum is generally in the

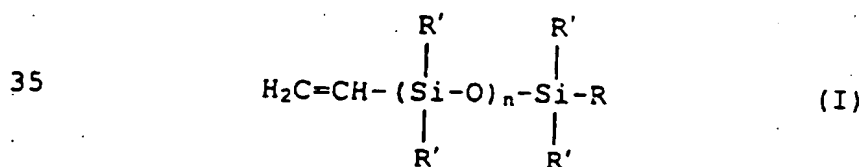
form of lumps, which are difficult to handle. In order to render it fluid it must be pre-heated and pumped. Further, admixed silicone gum has a tendency to migrate in the composition during extrusion, which may give rise to depositions, so-called die drool, on equipment such as dies used in the process. It also clogs the embossing wheels used for applying identification marks on cables. Besides, silicone gum constitutes an extra component, the handling of which entails longer processing times and higher costs.

According to the present invention the above mentioned disadvantages are alleviated or eliminated by a flame retardant composition comprising a copolymer which as a monomer includes a silicon-containing compound. Thus, instead of being mixed with the polymer of the flame retardant composition, the silicon-containing compound is polymerised into the polymer and forms an integral part thereof. Besides preventing die drool, this also results in a composition with fewer components than in the known compositions, and this constitutes yet another advantage and leads to a better homogeneity of the composition.

Another advantage with the composition according to the invention is the fact that less silicone compound is needed in the new composition compared to the known compositions.

Thus, the present invention relates to a flame retardant composition comprising:

(A) a polymer which includes a copolymer of ethylene and at least one other comonomer including a vinyl unsaturated polybishydrocarbylsiloxane according to formula (I):



wherein  $n = 1-1000$ , and R and R', independently, are vinyl; alkyl, branched or unbranched, with 1-10 carbon atoms; aryl with 6 or 10 carbon atoms; alkylaryl with 7-10 carbon atoms; or arylalkyl with 7-10 carbon atoms (preferred due to its commercial availability is vinyl polydimethylsiloxane); and

(B) an inorganic filler comprising at least one member selected from the group consisting of oxides, hydroxides and carbonates of aluminium, magnesium, calcium and barium.

It also relates to manufactured items containing such a composition and in particular to a cable or wire having a layer comprising such a flame retardant composition.

The characterising features of the invention will be evident from the following description and the appended claims.

Despite the fact that the siloxane according to the invention is polymerised, and thus bonded, a surprisingly good Limiting Oxygen Index (LOI) value is achieved; it is considerably higher than for a composition not comprising any silicone and of the same magnitude as LOI values for compositions comprising similar amounts of silicone gum mixed with a polymer.

The Limiting Oxygen Index (LOI), according to ISO 4589-A-IV, is a measurement of a products flame resistance. To determine the LOI-value a test specimen of the compound to be evaluated is ignited in an atmosphere of a mixture of nitrogen and oxygen. The content of oxygen in the  $N_2/O_2$  mixture is gradually decreased until the specimen stops burning. The percentage of  $O_2$  in that  $N_2/O_2$  mixture constitutes the compound's LOI-value. A high LOI-value means that a high percentage of oxygen is needed to sustain combustion, i.e. the compound has a good flame resistance. The LOI-value for a flame retardant composition should be at least 22, and higher values are desirable.

As indicated above, the polymer containing the vinyl unsaturated polybishydrocarbylsiloxane monomer of formula (I) is a copolymer of ethylene and the monomer of formula (I), optionally with one or more additional co-  
5 monomers. These additional comonomers are preferably selected from the group consisting of C<sub>1</sub>-C<sub>8</sub> alkyl acrylates, C<sub>1</sub>-C<sub>8</sub> alkyl methacrylates, acrylic acid, methacrylic acid, vinyl acetate, vinyl trimethoxysilane and vinyl triethoxysilane.

10 In this connection it should be noted that the term "copolymer" as used herein includes graft copolymers in which one or more of the comonomers is grafted onto the polymer backbone.

The above polymer including the monomer of formula  
15 (I) preferably comprises at least 40%, more preferably at least 60% by weight of the polymer of the flame retardant composition.

In addition to the above defined ethylene copolymer the composition according to the present invention may  
20 also include other, admixed polyolefins such as, for example, homopolymers and copolymers of ethylene, propylene and butene and polymers of butadiene or isoprene. Suitable homopolymers and copolymers of ethylene include low density polyethylene, linear low, medium or high density  
25 polyethylene, and very low density polyethylene. Other suitable polymers include polyesters, polyethers and polyurethanes. Elastomeric polymers may also be used such as, for example, ethylene-propylene rubber (EPR), ethylene-propylene-diene monomer rubbers (EPDM), thermo-  
30 plastic elastomer rubber (TPE) and acrylonitrile butadiene rubber (NBR). Silane-crosslinkable polymers may also be used i.e. polymers prepared using unsaturated silane monomers having hydrolysable groups capable of crosslinking by hydrolysis and condensation to form  
35 silanol groups in the presence of water and, optionally, a silanol condensation catalyst. The silane-crosslinkable polymer can be for example a copolymer of ethylene and an

unsaturated silane monomer, such as vinyl trialkoxy-silane, produced by copolymerising the monomers in a polymerisation reactor or by grafting the silane monomer onto a polyethylene backbone.

5       The amount of vinyl polybishydrocarbylsiloxane in the composition according to the present invention is approximately 0,01-30% by weight, preferably 1-10% by weight and more preferably 3-7% by weight.

10       The inorganic fillers suitable for use in the flame retardant composition according to the present invention are oxides, hydroxides and carbonates of aluminium, magnesium, calcium and/or barium. Examples of suitable inorganic fillers are calcium carbonate, magnesium oxide and huntite  $Mg_3Ca(CO_3)_4$ .

15       The amount of inorganic filler in the composition according to the invention is 10-70% by weight, and preferably 15-45% by weight.

20       In addition to the polymer and inorganic filler, the compositions according to the present invention may contain additional ingredients such as, for example, anti-oxidants and small amounts of other conventional polymer additives.

25       Suitable amounts of the components in the flame retardant composition according to the invention are specified above. However, it will be apparent to a person skilled in the art that the proportions to be used should be selected to give the required balance of properties, in particular to give balance between the flame retardancy and the physical properties of the composition.

30       The flame retardant compositions according to the present invention are suitable for use in, for example, cables such as installation cables and flexible cables, pipes, tubes, hoses, electrical contacts etc.

35       The invention is further illustrated by the following example, which in no way should be construed to limit the scope of the invention.

Example

The flame retardant composition according to the present invention was compared to known flame retardant compositions. The compounds used in this example were mixed in a Brabender cokneader at 160°C resulting in compounds comprising known compositions as well as a compound comprising the composition according to the invention and, finally, a compound containing no silicone. The evaluation of their LOI-values was performed, as described above, after milling the extrudate and moulding the resulting granulate into 3 mm thick sheets.

The compounds and the LOI-values are shown in table 1.

Compound 1 comprises only calcium carbonate as a flame retardant substance and no silicone. Compound 2 and compound 3 both comprise a flame retardant composition according to the present invention. Compounds 4-6 comprise different known flame retardant compositions.

The polymer in the flame retardant composition according to the invention in examples 2 and 3 was a terpolymer of ethylene, vinyl unsaturated polydimethylsiloxane and butyl acrylate.

The known flame retardant composition comprised mixtures of silicone gum with an ethylene-ethyl acrylate copolymer and different inorganic flame retardant additives.



Table 1

Component	Compound 1	Compound 2	Compound 3	Compound 4	Compound 5	Compound 6
CaCO <sub>3</sub> <sup>1</sup>	30%		30%			
Mg(OH) <sub>2</sub> <sup>2</sup>		30%		30%		30%
Mg(OH) <sub>2</sub> <sup>3</sup>					30%	
E/Si/BA-ter-polymer <sup>4</sup>		69.8%	69.8%			
Silicone gum				5%	5%	5%
EEA <sup>5</sup>	69.8%		64.8%	64.8%		64.8%
IB-215						
(Irganox, stabiliser)	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Density		1.17 g/cm <sup>3</sup>	1.17 g/cm <sup>3</sup>	1.18 g/cm <sup>3</sup>	1.18 g/cm <sup>3</sup>	1.15 g/cm <sup>3</sup>
LOI	20.8	30.6	29.6	39.2	35.2	37.0

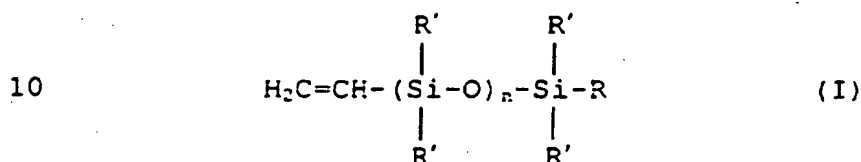
<sup>1</sup> Omya EX-H1 SP<sup>2</sup> Kisuma 5J from Kyowa Chemicals<sup>3</sup> FR 20 MHRM 105 from Dead Sea Bromine<sup>4</sup> Ethylene terpolymer containing 14% BA and 3.6% vinyl polydimethylsiloxane; n in formula (I) is 100<sup>5</sup> EEA = Ethylene/ethyl acrylate copolymer with 15.3% EA (grade OE5810 from Borealis)

The LOI-values obtained for the Compounds 2 and 3 according to the invention were markedly better than that of Compound 1 containing no silicone, but somewhat lower than those of the compounds containing a mixture EEA and silicone gum. It has to be remarked though that the total amount of siloxane in compounds 2 and 3 was 2.5%, i.e. only half of that in compounds 4-6, which contained 5% silicone gum. By increasing the siloxane content in the compositions according to the invention a higher LOI-value may be obtained.

## CLAIMS

1. A flame retardant composition comprising:

- (A) a polymer which includes a copolymer of ethylene and at least one other comonomer including a vinyl unsaturated polybishydrocarbylsiloxane according to formula (I):



wherein  $n = 1-1000$ , and  $R$  and  $R'$ , independently, are vinyl; alkyl, branched or unbranched with 1-10 carbon atoms; aryl with 6 or 10 carbon atoms; alkylaryl with 7-10 carbon atoms; or arylalkyl with 7-10 carbon atoms; and

(B) an inorganic filler comprising at least one member selected from the group consisting of oxides, hydroxides and carbonates of aluminium, magnesium, calcium and barium.

2. A flame retardant composition according to claim 1, wherein the copolymer includes at least one further comonomer selected from the group consisting of  $\text{C}_1-\text{C}_8$  alkyl acrylates,  $\text{C}_1-\text{C}_8$  alkyl methacrylates, acrylic acid, methacrylic acid and vinyl acetate.

3. A flame retardant composition according to claim 2, wherein the copolymer including the vinyl unsaturated polybishydrocarbylsiloxane comonomer constitutes at least 40% by weight of the polymer part of the total composition.

4. A flame retardant composition according to any one of claim 1-3, wherein the amount of vinyl polybishydrocarbylsiloxane comonomer is approximately 0,01-30% based on the weight of the total composition.

5. A flame retardant composition according to any one of claim 1-4, wherein the amount of vinyl polybis-

hydrocarbylsiloxane comonomer is approximately 1-10% based on the weight of the total composition.

- 5 6. A flame retardant composition according to any one of claim 1-5, wherein the amount of vinyl polybis-hydrocarbylsiloxane comonomer is 3-7% based on the weight of the total composition.

- 10 7. A flame retardant composition according to any one of claim 1-6, wherein the amount of inorganic filler is approximately 10-70% based on the weight of the total composition.

8. A flame retardant composition according to any of claim 1-7, wherein the amount of inorganic filler is approximately 15-45% based on the weight of the total composition.

- 15 9. A flame retardant composition according to any one of claim 1-8, wherein the polymer includes a copolymer of ethylene, a vinyl unsaturated polydimethylsiloxane according to formula (I), and butyl acrylate.

- 20 10. A cable or wire having a layer comprising a flame retardant composition according to any one of claim 1-9.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 97/01561

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: C08L 23/08, C08L 43/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0334205 A2 (SUMITOMO BAKELITE COMPANY LIMITED), 27 Sept 1989 (27.09.89), page 1, line 1 - line 10, claims 1-4, abstract	1-10
	---	
A	EP 0393959 A2 (BP CHEMICALS LIMITED), 24 October 1990 (24.10.90)	1-10
	---	
	-----	

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

17 December 1997

Date of mailing of the international search report

08-01-1998

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Barbro Nilsson  
Telephone No. +46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

02/12/97

International application No.  
PCT/SE 97/01561

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0334205 A2	27/09/89	SE 0334205 T3 AT 115608 T AU 3117089 A CA 1332016 A DE 68919879 D,T JP 1242645 A JP 1967023 C JP 6102741 B US 5002996 A JP 1967034 C JP 3028245 A JP 6102742 B JP 1254751 A JP 1967035 C JP 6102743 B	15/12/94 28/09/89 13/09/94 18/05/95 27/09/89 18/09/95 14/12/94 26/03/91 18/09/95 06/02/91 14/12/94 11/10/89 18/09/95 14/12/94
EP 0393959 A2	24/10/90	SE 0393959 T3 AT 129272 T AU 627296 B AU 5372090 A CA 2014357 A DE 69023039 D,T ES 2077644 T JP 2300249 A US 5091453 A	15/11/95 20/08/92 25/10/90 21/10/90 21/03/96 01/12/95 12/12/90 25/02/92

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**